KEYLIGHT
BY THE FOUNDRY

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Keylight User Guide
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INTRODUCTION

Welcome to this User Guide for Keylight on Combustion.

Keylight is an Academy award winning blue and green screen keyer. The core algorithm was developed by the Computer Film Company and has been further developed and ported to Combustion by The Foundry.

We hope you enjoy using Keylight.

About this Manual

Use the Quick Key chapter to see how a simple key is pulled using Keylight. The Basic Keying Chapter goes over the most common parameters you'll need to pull a variety of keys. The Advanced Keying Chapter explains how to tackle difficult keys.

Release Notes

For information on system requirements, new features, improvements, fixed bugs and known bugs & workarounds, see "Appendix A" on page 75.

Example Images

Example blue and green screen images for use with Keylight can be downloaded from our web site www.thefoundry.co.uk

Installation on Windows

To install Keylight on a Windows machine follow these instructions:

1. Download Keylight1.2v1_AE7.0-win-x86-release-32-Combustion.zip from www.thefoundry.co.uk and extract the installer from the zip archive by double clicking on it.
2. Double click on Keylight1.2v1_AE7.0-win-x86-release-32-Combustion.exe.
3. A window will appear welcoming you to the Keylight Setup. Click Next to continue to the end user license agreement.
4. When the end user license agreement appears, please read it. If you agree, click Yes to continue the installation.
5. Choose the location to install Keylight on your hard disk. To accept the default location, and it is strongly recommended that you do, just click Next to continue.
6. The Keylight plug-in will be installed but not licensed.
7. Click Finish to quit the installer.

Keylight can be found in the Operators - Keying menu.

Licensing

Keylight for Combustion is licensed using FLEXlm from Macrovision.

A node locked license will enable Keylight to work on one particular machine. It is locked to a unique number (lmhostid) on that machine. Node locked licenses do not require additional licensing software to be installed. In particular you do not need a FLEXlm daemon running. You just need the Keylight plug-in and a text file containing the license string. Your license key will look a little like this:

```
INCREMENT keylight_ae_i foundry 1.2 05-jul-2007 uncounted
      HOSTID=000ea641d7a1 START=8-nov-2006 SIGN="03C7 5A34
      BDE8 D421 6C2B 8111 8151 972A 14E2 C143 4C00 741F 730D
      784A D392 B1D9 9C3F 03FC DB2A E432 5EA7"
```

This license string should be put in a text file called foundry.lic in the same directory as the Keylight plug-in.

Important! *The really important bit is that the file has a .lic file extension (make sure there is no hidden file extension has been added for you), that it is a plain text file (not rich text) and that you put the file in the correct directory..*

Put the license key in this directory:

```
C:\Program Files\discreet\combustion 4\Plugins\Keylight-
      1.2\foundry.lic
```

You can get a temporary trial (demo) or permanent license from our web site www.thefoundry.co.uk or contact The Foundry directly.

lmhostid

To display this number click on the banner (Figure 1) in the Keylight plug-in. The lmhostid is displayed.

Figure 1. Click this for lmhostid.

Further Reading

For more information on licensing Keylight, moving the license file or working with floating licenses, read the Foundry FLEXlm Tools (FFT) User Guide available to download from our web site.

About The Foundry

The Foundry specialises in developing plug-in visual effects for compositing platforms in the film and video industry. Based in London's Soho, the Foundry has tailored its image processing tools to the needs of post production.

Tinder plug-ins have been developed by the Foundry and

have been sold to hundreds of users throughout the world. They are available on the leading compositing platforms including Discreet Frame, Avid DS, Shake and Adobe After Effects.

Furnace is a rich collection of image processing tools using motion estimation technology to help compositors tackle common problems when working on films. Plug-ins include wire removal, retiming, rig removal, texture plug-ins, grain management, steadiness and deflicker.

Anvil is a set of colour correction and colour manipulation tools. It was originally developed by Paul Grace at First Art and is now available on a variety of platforms.

Visit The Foundry's web site at www.thefoundry.co.uk for further details.

About CFC

The Computer Film Company (CFC) pioneered the field of digital film compositing and today operates a state of the art film effects facility in London. The company has always invested in research, and maintains the kind of edge that has twice been honoured with Technical Achievement Awards from the Academy of Motion Picture Arts and Sciences.

Visit Framestore-CFC's web site at www.framestore-cfc.com for further details.

GETTING STARTED

Introduction

Keylight has been refined over a number of years to make keying quicker and easier while providing a depth to the tools that will tackle even the most challenging shots.

Keylight was first developed by The Computer Film Company to help with difficult keys in feature films. Over the years Keylight has been refined in production on hundreds of films. This pioneering work on digital compositing was honoured with a Technical Academy Award® in 1996.

Notation

When we refer to blue screens throughout the text we mean, of course, blue or green screens.

Quick Key

Keylight is available from the Operators - Keying menu in Combustion.

Consider this shot from The Saint, pictures courtesy of CFC and Paramount British Pictures Ltd. Figure 2 is the blue

Figure 2. Blue Screen.

screen foreground that should be composited over the background shown in Figure 3.

Figure 3. Background.

If you want to have a go of this shot, you can! The images can be downloaded from our web site and this quick key is also covered in the Tutorial Chapter. See "Tutorial 1: Simple Key" on page 47.

Throughout this user guide we assume a good understanding of Combustion. To perform this quick key, do the following:

1. Create a new Workspace and import SaintFG.tif and SaintBG.tif. Layer the clips with the blue screen over the background as shown in Figure 4.

Figure 4. Screen Shot showing Saint blue screen.

2. Select the blue screen clip (SaintFG.tif) and apply AE Keylight-1.2 from the Keying menu of the Operators tab. See Figure 5.

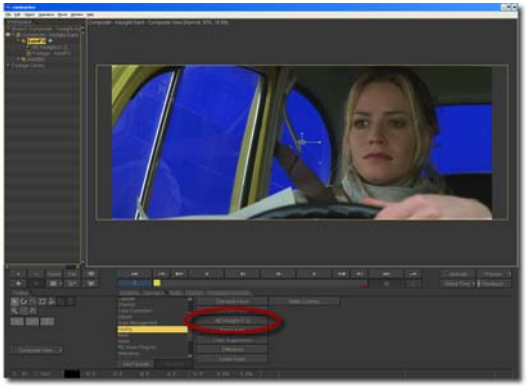

Figure 5. Apply Keylight from the Keying menu.

3. The Keylight parameters are shown in Figure 6.

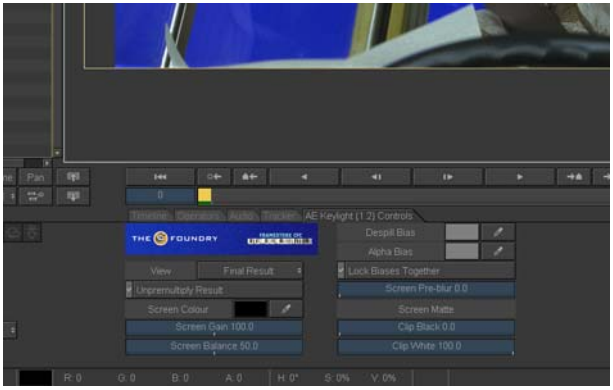

Figure 6. Keylight Parameters.

4. Select the Screen Colour eye dropper and click on the blue screen in the composition window. A good place to pick is the

Figure 7. Pick the blue from the back windscreen.

blue from the back windscreen as this has no reflections.

5. Picking this blue will key the back windscreen perfectly leaving reflections in the side window.

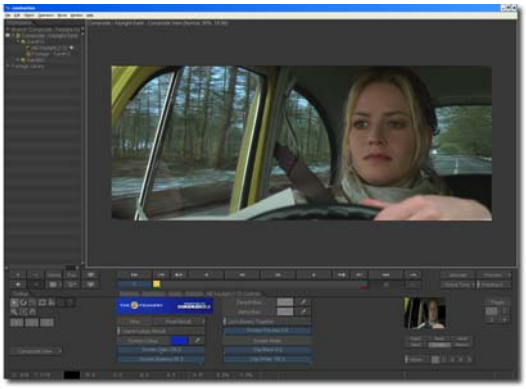

Figure 8. Keyed foreground over the background.

6. That's it. In many cases this is all you will need to do to perform a key, since selecting the screen colour creates a matte and despills the foreground. The final composite is shown in Figure 9.

Figure 9. Final composite.

There are a couple of extra steps that can be taken to fine tune this key and these are discussed in "Tutorial 2: Fine Tuning a Key" on page 52.

Picking the screen colour may be enough for a lot of keys, but there are many more tools within Keylight that can be used to tackle more complicated shots. These are described in later chapters.

BASIC KEYING

The following section describes the parameters you need to do basic keying. This will give you enough to tackle most simple keys. A discussion of advanced parameters to fine tune and tackle complex keys can be found in the next chapter.

Basic Workflow

The first step is always to pick the **Screen Colour**. Then view the composite and the screen matte.

If there is blue spill on the composite pick skin tones for the **Despill Bias** from the foreground actor.

If the background is showing through the foreground or the foreground is showing on the background, you need to improve your matte using the **Clip Black** and **Clip White** parameters. In the next chapter we'll look at ways of doing this with inside and outside masks. See "Inside Mask Tip" on page 40.

Screen Colour

The Screen Colour is probably the most important parameter and you should always pick the screen colour before doing anything else. It should be set to the colour of the green or blue curtain behind the foreground object. View the Source image in the Composite window, select the eye dropper and pick the screen colour. Setting the Screen Colour will create a matte - the Screen Matte - and despill the foreground. In some cases this is enough to get a decent key. For more information on Screen Colour see page 21.

Figure 10 shows a well lit blue screen behind an actor. You

Figure 10. Blue Screen.

should note that repeatedly picking the Screen Colour will override any previous selections. It will not add to previous selections and key more of the image with each click.

Note *You should always pick screen colours from the Source image and not the Final Result.*

Tip

It's worth picking several different blues and for each one viewing the matte and status to judge the key.

View

After picking the Screen Colour it's useful to be able to check the quality of the key by viewing the composite and the

screen matte. You can do this using the View Menu, shown

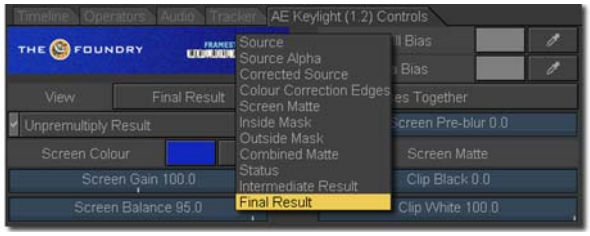

Figure 11. View Menu.

here in Figure 11. The options you'll use the most are:

- **Screen Matte** - this renders the matte created by picking the screen colour.
- **Status** - this renders an exaggeratted view of the mattes so that minor problems are shown clearly.
- **Final Result** - this renders the foreground composited over the background using all mattes, spill and colour corrections.

Status

The Status is one of the options in the View menu and shows an exaggerated view of the key so that you can make a more informed decision when refining the composite. Figure 13

Figure 12. Green Screen.

Figure 13. Status.

shows the Status display after the screen colour has been picked from the image shown in Figure 12. Three colours are displayed. Black pixels show areas that will be pure background in the final composite. White pixels show areas that will be pure foreground. Mid-grey pixels will be a blend of foreground and background pixels in the final composite. You need grey pixels around the edge of the foreground to get a good key at the foreground edge. However, if there are grey pixels where there should be pure background, you should try to remove these with the **Screen Strength**, **Clip Black** or Outside Mask. If you have grey pixels where there should be pure foreground this tells you that parts of the background will show through here and you will need to firm up the foreground with **Clip White** or an Inside Mask.

Pixels that are a blend between the foreground and background are shown in just one shade of grey. This is done to highlight potential problems with the key. These grey pixels may represent a foreground/background blend of 50/50 or 99/1. No distinction is made as to this ratio.

You may occasionally see other colours in the Status View and these are covered on page 32 in the Advanced Keying Chapter.

Despill Bias

Although the foreground is despilled automatically, you may find the need to pull out a little more of the screen colour

after picking from the image. You can do this with the Bias controls.

Figure 14. Exaggeratted blue spill.

Figure 15. Despill Bias used to remove the blue spill.

By default the Bias controls are locked together, which in the vast majority of cases, is the best way to use them. See "Despilling" on page 24 in the Advanced keying section for a look at a case where unlinking the bias controls is a good tactic.

Thus, using either bias control colour dropper, pick the predominant foreground colour. In the majority of cases it's best to pick skin tones from the foreground actor, as viewers tend to be most tuned to colour shifts in these areas.

ADVANCED KEYING

The following section describes the parameters you need to fine tune keys and get the most out of Keylight. Basic parameters covered in the previous chapter may also be covered here in more detail.

Screen Colour

The screen colour represents the colour of the pure blue (or green) screen. The first thing you should do when pulling a key is pick the Screen Colour. This single colour has a primary component, blue or green, and that has a saturation. Once the screen colour has been picked, Keylight analyses all the pixels in the image and compares the saturation of the primary component in each of these pixels with the corresponding saturation of the screen colour, setting the alpha and modifying the colour accordingly.

Tip

Picking different shades of blue or green from the background can give quite different results. It's worth experimenting with different screen colours if your initial pick didn't give a good key.

Workflow Tip

It can also be useful to view the Status and Source side by side as shown in Figure 16 so that you can repeatedly pick from one while viewing the result in the other window.

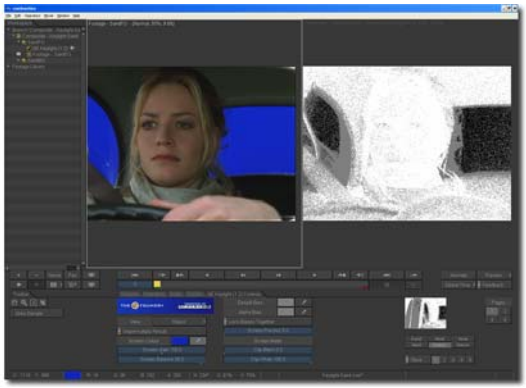

Figure 16. Two Views.

Background Pixel

If the saturation of the pixel in the image is as strong, or

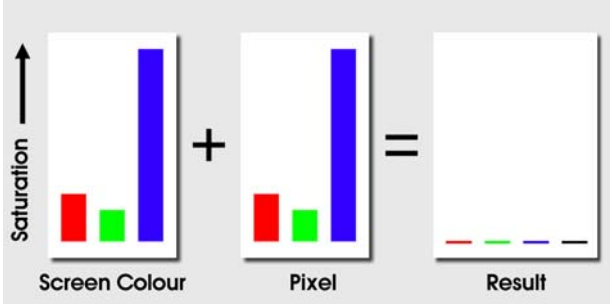

Figure 17. Blue screen pixel set alpha to zero.

greater than the screen colour, then it'll be a pixel from the

blue screen background, and that pixel will be set to completely transparent and black. See Figure 17.

Edge Pixel

If the saturation of the pixel is less than the screen colour, then it'll be the edge of the foreground object, and we subtract some of the screen colour from the pixel (de spilling) and set the image to semi-opaque. See Figure 18.

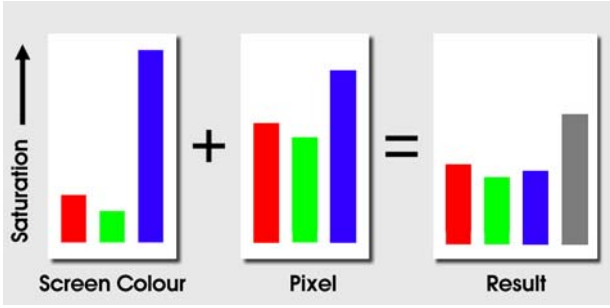

Figure 18. Edge pixel gives partial alpha.

Foreground Pixel

If the primary component in the pixel is not the same as the primary component of the screen colour we have a

foreground pixel, and the alpha is set to completely opaque.

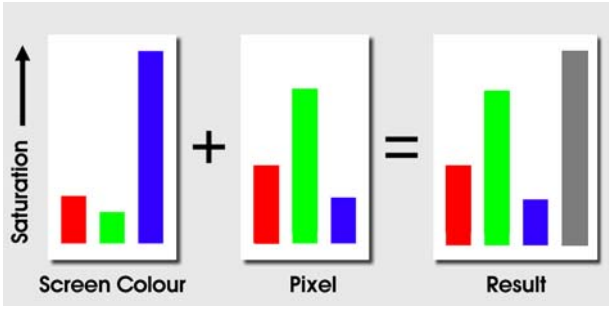

Figure 19. Foreground pixel gives full alpha.

The pixel colour is not modified. See Figure 19.

Note *You should note that the Screen Colour is a single colour. You are not picking lots of colours that are keyed out.*

Despilling

Although picking the screen colour will remove blue spill, it may not be enough. To despill more use the Despill Bias control. By default this is linked to the Alpha Bias. In the rare case that the screen has been so badly shot that it's not really blue or green anymore, the alpha bias can be used to get a good key.

Despill Bias

Consider Figure 20 from the film "Merlin". Pulling a default

Figure 20. Original blue screen.

Figure 21. Default key.

key from this will give the extreme blue spill around the edges of her hair as shown in Figure 21. To reduce this select the Despill Bias colour and pick skin tones from the foreground image. This result is shown in Figure 22. The alpha channel is shown in Figure 23.

Figure 22. Despill Bias.

Figure 23. Alpha.

Alpha Bias

You should not normally need to adjust the alpha bias seperately to the Despill Bias, but on those rare occasions when your green screen is more red than green it can be used to put things right in what would otherwise be an un-

keyable shot. Consider the image shown in Figure 24. This

Figure 24. Is this the worst green screen you've ever seen?

shot, from the film Executive Decision, is actually a green screen although it doesn't look it. The colour of the screen in the background is around 28% red, 25% green and 8% blue. This is in fact red, but only just. Note that the pilot in the cockpit is predominantly brown, at around 42% red, 25% green, 15% blue. So a default key from that screen colour would make the foreground transparent (Figure 25) as it is a more saturated red than the red of the screen colour.

Figure 25. Default key showing the transparency of the foreground.

In this situation, the Alpha Bias can help. View the Source, unlink the Bias controls, then select the Alpha Bias and pick colours from his mask. Now pick the same colours for the Despill Bias. This gives the result shown in Figure 26.

Figure 26. Alpha Bias and Despill Bias.

Screen Gain

The screen gain controls how much of the screen colour is removed to make the screen matte. Increasing this value will

Figure 27. Status after picking the Screen Colour.

Figure 28. Status showing the increase in Screen Gain.

key more. For the most part, a better way of improving the matte is using the Clip Black and Clip White controls.
Figure 27 shows the Status after picking the screen colour.

You can clearly see that parts of the background are grey where they should be black. When composited you may see faint pixels from the foreground where you should be seeing pure background. Increasing the screen gain will fix this, as shown in Figure 28, but increasing it too much will destroy your good work. Like many keying parameters it's a balance - not too much, not too little. Increasing the screen gain too much will lead to the background showing through the foreground and edge detail will be destroyed. Figure 30 on

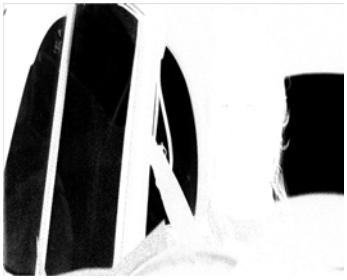

Figure 29. Screen Gain = 100 giving a good screen matte.

Figure 30. Screen Gain = 150 giving background show through and over eroded edges.

page 28 shows this quite well. Note the steering wheel is black when it should be white. If you look at the composite you will see the background showing through here. Also, some of the fine hair detail on the actor, visible in Figure 29, has been eroded in Figure 30.

Screen Balance

Saturation is measured by comparing the intensity of the primary component against a weighted average of the two other components. This is where the **Screen Balance** control comes in. A balance of 100% means that the saturation will be measured against the smallest of the other two components in the screen colour.

A balance of 0% means that the saturation will be measured against the larger of the other two components. A balance of 50% will measure the saturation from the average of the other two components.

The appropriate balance point for each image sequence you key will be different depending on the colours in that image. Generally speaking, blue screens tend to work best with a balance of around 95% and green screens with a balance of around 50%. If the key is not working too well with these settings, try setting the balance to about 5%, 50% and 95% and see what works best.

Clip Levels

The clip levels are adjusted using two parameters – **Clip Black** and **Clip White**. Any alpha value at or below Clip Black will be set to zero and any alpha value at or above Clip White will be set to 100. Figure 31 shows the original alpha of an

Figure 31. Clip Black = 0.

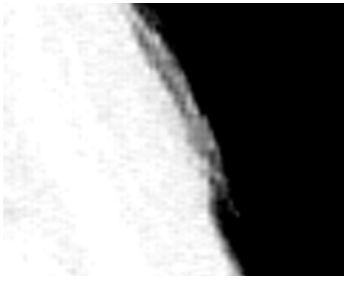

Figure 32. Clip Black = 50.

image and Figure 32 on page 29 shows the result of clipping it. Notice how the grey areas in the black background have been reduced and that the grey edges have hardened up considerably. When compositing, the Clip Black control can be used to improve the background image if parts of the

foreground are showing through. The Clip White control on the other hand can be used to firm up the centre of the matte, making it less transparent to the background.

Note *You need to be really careful if you chose to use Clip Black and Clip White that you don't destroy the edges on your foreground. It is possible to use Clip Rollback to compensate for this.*

View

After picking the Screen Colour it's useful to be able to view the key in different ways. You can do this using the View

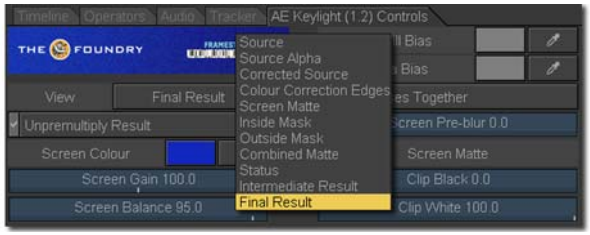

Figure 33. View Menu.

Menu, shown here in Figure 33. Here's the complete list of options and what they do.

- Source - displays the blue or green screen.
- Source Alpha - displays the alpha channel embedded in the blue or green screen.
- Corrected Source - displays the uncomposited source image with any colour corrections applied.
- Colour Correction Edges - displays the foreground edges as a matte that will be colour corrected using the controls in the Edge Colour Correction folder.
- Screen Matte - displays the matte created as a result of picking the screen colour.
- Inside Mask - displays the mask that firms up the foreground.

- Outside Mask - displays the mask that cleans up the background.
- Combined Matte - displays all the screen matte, inside and outside masks and any source alpha added together. The combined matte is used to composite the foreground over the background layer.
- Status - displays an exaggerated view of the key so you can make a more informed decision on how to improve the result. See "Status View" on page 31.
- Intermediate Result - is used for multipass keying. The alpha is set as per normal, but the RGB values are not modified from the original source image. See "Inside Mask Tip" on page 40.
- Final Result - renders the foreground composited over the image on the background track. This image is premultiplied. In other words, the RGB values of pixels have been multiplied by their corresponding alpha channel values.

Status View

The Status View is one of the options in the View menu and shows an exaggerated view of the key so that you can make a more informed decision when fine tuning the composite.

Figure 34. Green Screen.

Figure 35. Status.

Figure 35 shows the Status after the screen colour has been picked from the image shown in Figure 34 on page 31. Three colours are displayed. Black pixels represent pure background in the final composite. White pixels are pure foreground and grey pixels are a blend of the foreground and background pixels. The grey is just one colour to highlight any areas that are not pure foreground or background. Grey pixels do not mean the key is poor – the final composite may be fine.

You may occasionally see other colours in the Status View.

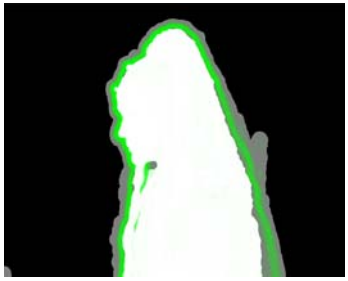

Figure 36. Status showing processing of the Screen Matte.

Figure 37. Result showing Screen Matte Replace Colour.

Figure 36 shows black, white, grey and green pixels. The green pixels are a warning. They show you the parts of the Screen Matte that have changed through processing the matte (clipped, softened or eroded). These areas have had the correct amount of spill removed, but the alpha has subsequently changed and the composite may no longer look right. This can be corrected using the Replace Colour to put back colour in these areas. Figure 37 on page 32 is an extreme example to illustrate the point. The Replace Colour has been set to pure red and you can see that this mirrors the green pixels in the Status View.

Similarly you may see blue pixels in the Status. These

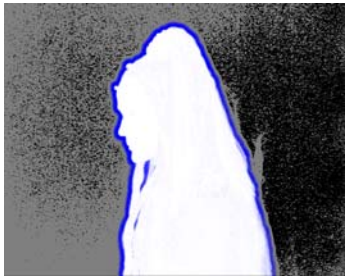

Figure 38. Status showing how the Inside Mask will affect the foreground.

Figure 39. Final Result showing the Inside Mask Replace Colour.

represent processed pixels in the Inside Mask that affect the despill of the foreground. The Replace Colour in the Inside Mask folder will be used to modify these pixels. Another extreme example is shown in Figure 39. The Replace Colour is set to pure yellow and the Replace Method is Hard Colour.

You may also see dark red pixels which indicate areas where an outside mask has been used to reduce the transparency of the image.

Screen Matte

The Screen Matte (Figure 41) is the result of pulling the blue or the green from the image (Figure 40) and making those

regions transparent. Once you have done this you will want

Figure 40. Green screen.

Figure 41. Screen Matte.

to firm up the foreground (make it more white) and clean up the background (make it more black). This can be done by processing the Screen Matte.

Clip Rollback

Pulling a Screen Matte (Figure 42) will typically produce lots of transparency (grey) in the matte at the edges. This is good since this is what you need to key hair well. You may also get transparency in the foreground as shown in Figure 43. This is bad as your subject will appear slightly see-through, and

this should be corrected. You can do this with an inside mask

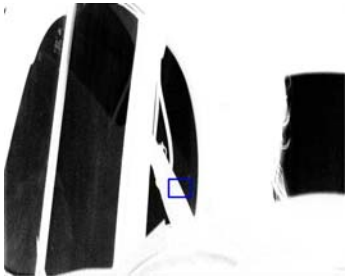

Figure 42. Screen matte highlighting the close up view as shown in Figure 43.

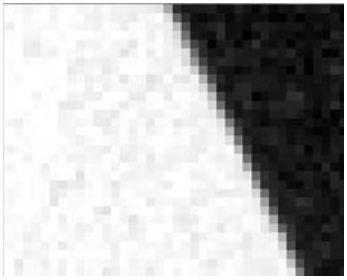

Figure 43. Close up screen matte showing unwanted (grey) transparency in the (white) foreground.

shape, or you can use the Clip White parameter to turn these grey pixels white. This cleans up the foreground (Figure 44) but it will also destroy the edge detail you want to keep. This is where Clip Rollback comes in. This is used to put back the edges to restore the detail that was lost. A rather exaggerated clip rollback is shown in Figure 45 to illustrate the point.

Figure 44. Clip White has been used to remove the unwanted grey pixels in the white matte.

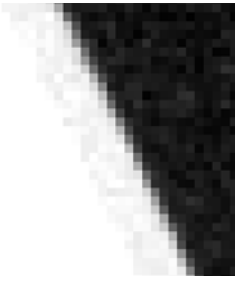

Figure 45. Clip Rollback has been used to reduce the unwanted erosion of the edge.

Grow & Shrink

This control should not normally be used as eroding the edges can produce a very poor key. However, this parameter allows you to grow (if greater than zero) or shrink (if less than zero) the alpha in the Screen Matte. These controls are sub-pixel accurate.

Figure 46. Screen Matte.

Figure 47. Eroded Matte.

There is, however, one circumstance where heavy eroding is useful and that is for producing a matte used as an inside mask. See "Inside Mask Tip" on page 40.

Despot

This controls how much to simplify the matte. It coagulates similar regions so that, for example, black specks in the white matte can be absorbed by the surrounding white areas. Increasing the **Screen Despot Black** will remove isolated spots of black in the white matte. Increasing Screen Despot

White will remove isolated spots of white in the background up to that size.

Figure 48. Eroded matte.

Figure 49. Despot.

Colour Replacement

Remember that Keylight does two things - it removes the screen colour to despill the image and generates an alpha (Screen Matte) to composite the foreground over the background layer.

If you then process the Screen Matte, for example, by eroding the matte or changing the clip levels, Keylight will be removing the wrong amount of screen colour from the pixels whose transparency have now changed. The **Replace Method** instructs Keylight how to deal with such pixels. The Status will display which pixels use a replace method. Those pixels who use a replace method because the Screen Matte processing tools modified the transparency will be green, whilst those pixels whose transparency was modified by the inside mask will be blue. See the Status View on page 32.

There are four options to the replace method, these are:

1. **None -** the despilled image is left untouched if the alpha is modified.

2. **Source –** the image will have a corresponding amount of the original pixel (screen colour and all) reintroduced/removed if the alpha is changed.
3. **Hard Colour –** the despilled image has a corresponding amount of the replace colour added for any increase in alpha.
4. **Soft Colour –** the despilled image has a corresponding amount of the replace colour added for any increase in alpha, however, it attempts to modulate the luminance of the resulting pixel so that it matches the original pixel. This will give a more subtle result than the Hard Colour option.

Inside & Outside Masks

If you can't adequately improve the Screen Matte using the Clip Levels, you can input a mask that defines the foreground or background. The Inside Mask makes the foreground less transparent and the Outside Mask is used to clean up the background that might have bits of the foreground showing through. The outside mask is often used to clean up screens that are not a constant colour or have lighting rigs in shot (Figure 50) by forcing the alpha transparent. The inside mask

Figure 50. Green Screen with lighting rig visible.

can be used to keep elements in the foreground that you don't want to lose (an actor's blue eyes in front of a blue

screen). These masks should normally be softened to blend into the Screen Matte.

Figure 51 on page 39 shows a Combustion Mask drawn around the lighting rig on the left side of the screen. When this is used as the Outside Mask and the View control set to render the Outside Mask, you will see the image displayed in Figure 52. The outside mask forces that part of the image to

Figure 51. Mask drawn round the lighting rig.

Figure 52. Mask used as an Outside Mask and Viewed.

be in the background thus keying out the rig. The Screen

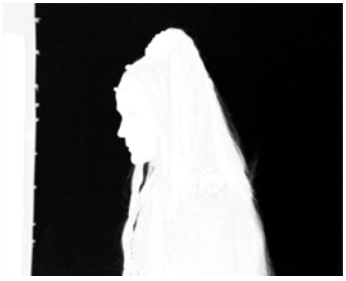

Figure 53. Screen Matte.

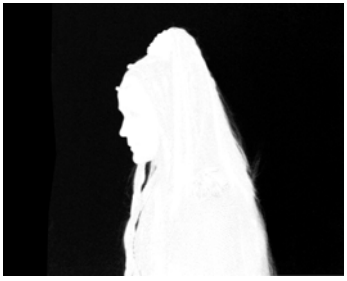

Figure 54. Combined Matte.

Matte shown in Figure 53 shows the matte pulled when the green screen is picked. When the Outside Mask is subtracted from the Screen Matte we get the Combined Matte, shown in

Figure 54. Here you can see the change in the matte that will result in the lighting rig being keyed out in the final composite. Figure 55 shows the Combustion Schematic.

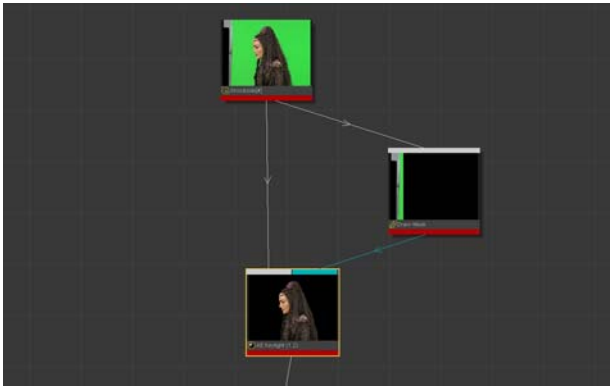

Figure 55. Schematic showing Outside Mask input to Keylight.

Source Alpha

This parameter determines how to deal with any embedded alpha in the original image.

- **Ignore** – this will not use any embedded alpha in the key.
- **Add to Inside Mask** – the embedded alpha is added to the inside mask.
- **Normal** – the embedded alpha is used to key the layer as normal. It is added to Keylight's screen matte and can be useful if requiring complicated multi-shaped masks to rotoscope out garbage.

Inside Mask Tip

An alternative and very powerful use of the Source Alpha option is to provide a solid inside mask pass-through in multipass keying. In other words you can use Keylight to pull

a really harsh eroded matte that can be used to stop print through in a second key that concentrates on the edges. Print through is where the background shows through the foreground in a composite. Here's how you do it.

1. Apply Keylight to your footage and pick the screen colour.
2. Using Clip White, Clip Black and Screen Shrink/Grow while viewing the Screen Matte, get a very harsh eroded matte as shown in Figure 56.

Figure 56. Highly eroded matte.

3. Switch the View to Intermediate Result to pass through the RGB channels unaffected with the screen matte in the alpha channel. It looks a bit odd but don't worry.
4. Now apply a second Keylight and pick the screen colour as normal. Looking at the Status display as shown in Figure 57 you

should be able to see the background showing through the foreground white areas.

Figure 57. Status for default key showing foreground transparency.

5. To fix this we'll use the harsh matte we pulled in the first key. In the Inside Mask group, switch Source Alpha from Ignore to Add To Inside Mask. The result is shown in Figure 55.

Figure 58. Status showing improved foreground as a result of adding the harsh matte from the first key.

6. With a good foreground, you can now concentrate on pulling a subtle key for the edges without worrying about the background showing through the foreground. You may also need to use a very rough garbage mask to improve the background particularly for unevenly lit screens.

Colour Correction

The Colour Correction parameters allow you to modify the foreground colours in your composite. In particular, reflected blues and greens from the screen can be suppressed.

Saturation – this control will increase or decrease the colour saturation of the image, making colours more or less intense.

Contrast – the contrast is the ratio of brightest tones to the darkest. Increase this value for a contrasty image and decrease it to wash it out.

Brightness – the brightness equates to the overall luminance of the image. Increase this value to make the image lighter and decrease this value to make it darker.

Colour Suppression

Suppress – this controls colour suppression in the image. You can choose to remove a specific primary, either Red, Green, Blue or their complements, Cyan, Magenta or Yellow. For green screens you may find it helpful to suppress green.

Suppression Balance – determines what to reduce the suppressed component to. If set to 0%, it will be the smallest of the other two components, if set to 100% it will be the largest of the other two components. Otherwise, it will be to a balanced average.

Suppression Amount – determines how strongly you want to reduce the indicated component.

Colour Balancing

These controls are used to alter the colour balance of the image. Choose a hue and saturation (either via the sliders or the colour balance wheel) to shift the entire colour balance of the image.

Edge Colour Correction

The Edge Correction parameters allow you to colour correct edges to seat the composite into the background. To see the areas considered an edge that you will be affecting, select the Colour Correction Edges from the View menu.

Enable Edge Colour Correction – use this option to separately colour correct edges of the image independently from the overall colour correction.

Edge Hardness – this determines how strongly to blend between the edge correction and the main correction.

Edge Softness – this will soften the region considered to be the edge by this amount (in pixels).

Edge Grow – this will grow the region considered to be the edge by this amount (in pixels).

Saturation – these controls determine how much to scale the saturation of the image.

Contrast – this control increases/decreases the contrast on the region considered to be the edge.

Brightness – this control brightens the region considered to be the edge.

Edge Colour Suppression

Controls the colour suppression in the image.

Suppress - Choose to completely remove a specific primary, either Red, Yellow, Green, Blue or their components, Cyan, Magenta or Yellow**.**

Suppression Balance – determines what to reduce the suppressed component to. If set to 0%, it will be the smallest of the other two components, if set to 100% it will be the largest of the other two components. Otherwise, it will be to a balanced average.

Suppression Amount – determines how strongly you want to reduce the indicated component.

Colour Balancing

These controls are used to alter the colour balance of the image edges. Choose a hue and saturation (either via the sliders or the colour balance wheel) to shift the entire colour balance of the image.

Source Crops

The Source Crops enable you to quickly cut out lighting rigs or other unwanted elements using vertical and horizontal lines.

Keylight requires access to source pixels that lie off the edge of the source image. The cropping controls provide access to all the controls required for specifying how pixels are treated at these edges and where they appear. The built-in crop controls are also useful for removing unwanted black pixels at the edge of video footage.

X Y Method – determines the behaviour of the image at the left and right crop boundaries. Four edge methods are supplied:

- **Colour –** fills the area between the crop line and the edge with the Crop Colour.
- **Reflect –** reflects pixels about the current crop line. In other words, it copies pixels from the other side of the current crop line into the area between the current crop line and the screen edge.
- **Repeat –** copies pixels on the crop boundary to the screen edge.
- Wrap – copies pixels from the area between the opposite crop line and its screen edge to the area between the current crop line and its screen edge.

Note *Horizontal and vertical crop boundaries can have different edge methods, Cropping is often used to remove unwanted pixels at the edge of an image. If a video clip is digitized badly you may get black edges left and right. These can be easily removed by moving the vertical crops and setting the edge method to Reflect.*

Edge Colour – sets the fill colour used when the edge method is set to Colour.

Edge Colour Alpha – sets the fill colour transparency.

Left, Right, Top, Bottom – use these controls to set the crop positions. Lines will be overlaid in the display enabling you to set the various positions by eye.

Note *The position of the crop lines can be changed by clicking and dragging them directly on the screen.*

TUTORIAL

Introduction

We have included several tutorials with example images that you can use to practice Keylight.

- Tutorial 1: Simple Key
- Tutorial 2: Fine Tuning a Key
- Tutorial 3: Extreme Blue Spill
- Tutorial 4: A Red Green Screen
- Tutorial 5: Inside & Outside Masks
- Tutorial 6: Keying & the Schematic

Example Images

The tutorial images referred to in this chapter can be downloaded from our web site www.thefoundry.co.uk.

Tutorial 1: Simple Key

Using the blue screen clip from The Saint, you will composite the actor over the background. You will learn how to:

- Apply Keylight to a layer.
- Pick the Screen Colour.
- View the Final Result.

The clips you will need for this task are called SaintFG.tif and SaintBG.tif, pictures courtesy of CFC and Paramount British Pictures Ltd. for the film The Saint. You should import them

into Combustion and create a new composition containing the blue screen of Elizabeth Shue layered over the road.

Figure 59. Blue Screen - saint.tif

Figure 59 is the blue screen foreground that should be

Figure 60. Background - road.tif

composited over the background shown in Figure 60.

1. Create a new composition using SaintFG.tif and SaintBG.tif, layer the clips with the blue screen over the background as shown in Figure 61.

Figure 61. Screen Shot showing Saint blue screen.

2. Select the blue screen clip (SaintFG.tif) in the Schematic window and apply Keylight from the Operators - Keying menu. See Figure 62.

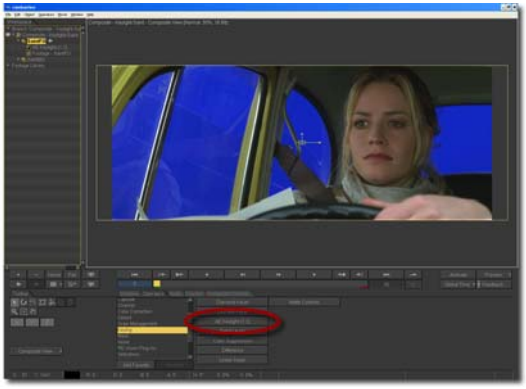

Figure 62. Apply Keylight from the Operators - Keying menu.

3. The Keylight parameters are shown in Figure 63.

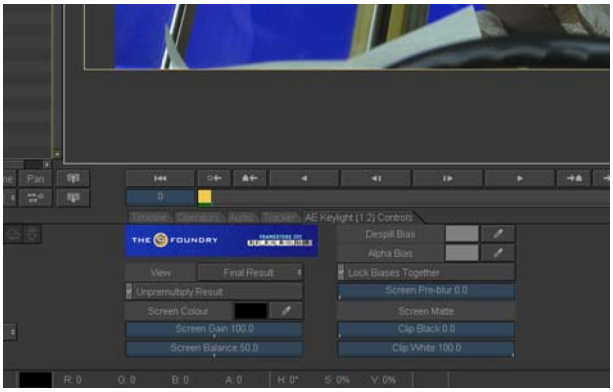

Figure 63. Keylight Parameters.

4. Select the Screen Colour eye dropper and click on the blue screen in the composition window. A good place to pick is

Figure 64. Pick the blue from the back windscreen.

the blue from the back windscreen as this has no reflections. See Figure 64.

5. That's it. In many cases this is all you will need to do to perform a key, since selecting the screen colour creates a

matte and despills the foreground. The final composite is shown in Figure 65.

Figure 65. Final composite.

There are a couple of extra steps that can be taken to fine tune this key and these are discussed in the next tutorial on page 52.

Tutorial 2: Fine Tuning a Key

Using the images from the film The Saint, you will learn how to fine tune the key pulled in Tutorial 1. You will learn how to:

- Use Status to judge the quality of the key.
- Use the Screen Gain to improve the background.
- Use the Despill Bias to remove more blue spill.

1. Create a new composition using SaintFG.tif and SaintBG.tif. Apply Keylight to the blue screen layer. Select the Screen Colour eye dropper and click on the blue screen in the composition window.

Note *These steps were covered in greater detail in the previous chapter.*

2. Before we do anything else we need to look at the quality of the key so far. On first inspection, the composite looks pretty good, but it's hard to judge. To see any potential problems more clearly, switch to the Status view as shown in Figure 66. Here we can see that the windscreens

Figure 66. Status showing grey pixels in the background.

are a mixture of black and grey pixels. The black pixels tell us that pure background will be seen here in the final composite. The grey pixels tell us that there will be a mix of foreground and background pixels. What we want is a clean background showing through the windows, but with

some reflections in the side window preserved. In other words we need mostly black pixels with a few grey ones.

3. Figure 67 on page 53 shows the Status view that we're aiming for. The background has been cleaned up and we still have some reflections in the side window. To get this you should increase the Screen Gain from 100 to 112.

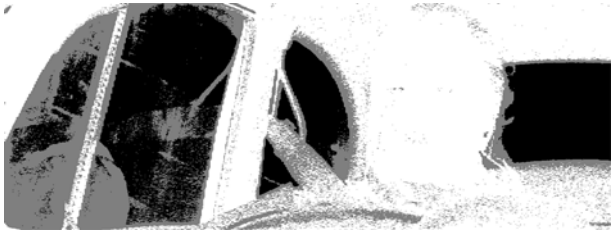

Figure 67. Improved background with Screen Gain.

4. Finally, if you look closely at the composite you will see a tiny amount of blue spill on the woman's hand and in her hair. This was from reflected light from the blue screen. Pick skin tones for the Despill Bias to remove it.

Figure 68. Final Composite.

Tutorial 3: Extreme Blue Spill

This is a really interesting clip from the film Merlin. The results with Keylight are certainly not perfect, indeed it is unlikely that you will ever end up with a truly realistic looking shot. However, there are some interesting things to observe. You will learn how to:

- Reduce the blue spill using Screen Balance and Despill Bias.
- Improve the foreground opacity using Alpha Bias.

1. Load the MerlinBlueFG.tif (Figure 69) and MerlinBlueBG.tif clips and apply Keylight.

Figure 69. A tricky blue screen.

2. Pick the Screen Colour using the eye dropper.

Figure 70. Serious blue spill.

Pick a pure blue pixel away from the hair.

3. Increase the Screen Gain from 100 to 105. This will clean up a little of the background.
4. Alter the Screen Balance from 95 to 0 as shown in Figure 71. This step is a bit subjective, but improves the blue spill.

Figure 71. Adjust the Screen Balance

5. Now let's try and get rid of that blue spill. switch off Lock Biases Together and pick skin tones for the Despill Bias. When you do this the image and the screen colour will have the blue component scaled up before the key is pulled so that more blue is removed.

Figure 72. Despill Bias.

6. You will notice that Miranda Richardson's face now has a number of blue highlights, due to the transparency, that we should fix. The best way to do this is by drawing a spline round the face as shown in Figure 73 and using it

Figure 73. Inside Mask spline.

as an Inside Mask. Refer to your Combustion guide for more information on masks, however, add a Draw Mask node and draw a bezier spline around the face on the first frame. Connect the Draw Mask node to the Inside Mask input in the Keylight node in the Schematic. Edit the Keylight parameters and check that the Inside Mask is set to the Draw Mask node and the Mask With set to Matte Layer Alpha. You should also soften the mask slightly by setting the Inside Mask Softness to 5. This fixes the background showing through.

7. To remove the blue highlights on the cheeks (Figure 74) you need to set the Replace Method to Soft Colour rather than Source.

Figure 74. Replace - Source.

Figure 75. Replace - Soft Colour.

8. View Final Result as shown in Figure 76.

Figure 76. Final Key.

Tutorial 4: A Red Green Screen

Using the images from the film Executive Decision, you will learn how to pull a key from a poor green screen using the Despill Bias control. You will learn how to:

- Pick the Screen Colour.
- Use Despill Bias and Alpha Bias.
- Produce a final composite.

The images you will need for this tutorial are called ExecFG.

1. Load the pictures ExecFG.tif (Figure 77) and ExecBG.tif. Apply Keylight. The foreground image is actually a green

Figure 77. Poor Green Screen.

   screen shot although it doesn't look it. If you analyse the pixels it's slightly more red than green. To key this we'll have to fool Keylight.
2. Pick the Screen Colour. You should go for the slightly darker green patch to the left of the pilot. Although feel free to experiment picking different parts of the green

screen. The initial selection gives the result shown in Figure 78.

Figure 78. Default key.

3. To fix this we need to tell Keylight to scale down the red component to make the green the most dominant so that it keys correctly. To do this pick colours from the mask for both the Despill Bias and Alpha Bias. The result is shown in Figure 79.

Figure 79. Despill Bias and Alpha Bias.

4. If you look closely, the background and foreground needs cleaning up. Figure 80 shows the Status View. We will use

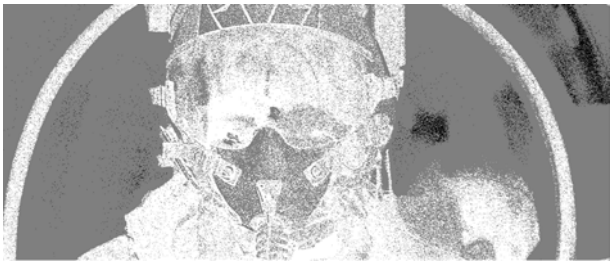

Figure 80. Status View.

the Screen Matte tools to make the cockpit windows black and the pilot white.

5. Increase Clip Black to 20 to remove some of the foreground showing through the background. Decrease Clip White to 70 to improve the opacity of the foreground. Increase Screen Softness to 1, Screen Despot Black to 2 and Screen Despot White to 2.

Figure 81. Composite.

6. Use the Screen Matte Replace Method to pull some of the original image through the composite. This improves the

apparent graininess in the foreground. Figure 82 shows the differences.

Figure 82. Close up view. The left image has Replace Method set to Source. The right image has Replace Method set to None.

Tutorial 5: Inside & Outside Masks

Using the 16 bit blue screen test card image you will learn how to:

- Use Inside and Outside Masks.
- Use the Replace Method to put back keyed out colours.
- Process the Screen Matte.

The clips you will need for this task are called TestCard.cin and ColourGrid.cin

1. Start Combustion. Create a new 16 bit workspace. Import the pictures TestCard.cin (Figure 83) and ColourGrid.cin

Figure 83. Test Card.

and put them into the composition layering the blue screen over the colour grid.

2. Apply Keylight to the blue screen layer and pick the blue from the image. Keylight will create a matte and despill

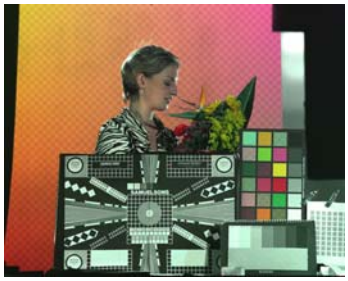

Figure 84. Basic Key.

the foreground as shown in Figure 84.

3. To remove the garbage around the subject we will use an outside mask. Using Combustion's Draw Mask node, draw a spline around the person and test cards. This is shown as the yellow line in Figure 85. Put the output of the Draw

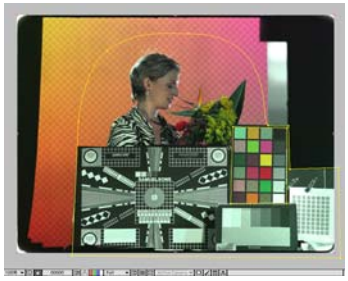

Figure 85. Outside Mask.

Mask node into the second, Outside Mask, input of the Keylight node.

4. In Keylight, check that the Outside Mask is set to the Draw Mask node and switch Invert on or you'll be

Figure 86. Outside Mask.

removing the person rather than the unwanted pixels at the screen edges.

5. You will have noticed in Figure 86 the "dirt" around the

Figure 87. Status View.

subject's head. Clearly we have to improve the key. You can also see the faults in the matte if you view the Status as shown in Figure 87.

6. Increase the Screen Gain to 110. This cleans up some of the background as shown in Figure 88.

Figure 88. Increase Screen Gain.

7. Sections 7 to 10 will cover the changes to the Screen Matte that will improve the key. In the Screen Matte parameter area, decrease the Clip White from 100 to 70.

Figure 89. Clip White.

This will improve the foreground as shown in Figure 89. However, you will notice in the composite that the edges have become a little hard. We can fix this using the Clip Rollback and Screen Softness.

8. Increase the Clip Rollback to 3 and the Screen Softness to

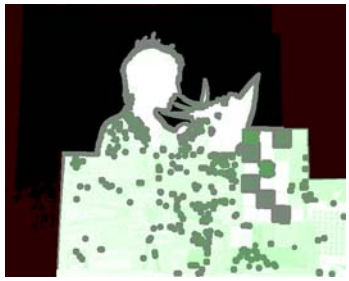

Figure 90. Rollback and Softness.

1. It's also worth trying to improve the key around the spiky flowers with a sub-pixel erode of the edge. Change Screen Grow/Shrink to -0.5.

9. To remove the foreground spots increase Screen Despot

Figure 91. Screen Despot Black.

Black to 1. The result is shown in Figure 91.

10. The composite is shown in Figure 92. You will see that the colours of the colour swatches have been altered by

the Keylight algorithm. This can be fixed with an Inside Mask.

Figure 92. Composite.

11. Draw a rough mask around just the colour swatches and

Figure 93. Inside Mask and Replace Method Source.

feed this into the Inside Mask input of the Keylight node. Set the Keylight Replace Method to Source to pull back the original colours.

12. That's it.

Tutorial 6: Keying & the Schematic

Combustion's schematic is a powerful and intuitive way to build up keys using multiple passes. In this tutorial we will take a simple key and use it to demonstrate some flexible node based keying techniques. We will cover:

- Using multiple viewers for quick colour picking.
- Applying vector based Inside and Outside masks using Combustion's native masking toolset.
- Using a previous key as an Inside mask to prevent print through.

The clips you will need for this task are called MerlinGreen.tif and Curtain.tif and can be found in the MerlinGreen archive on the Products-> For Combustion->Keylight -> Examples page of our website.

1. Start Combustion. Create a new composite. Load in the footage and wire them in so the green screen clip is layered over the curtain.

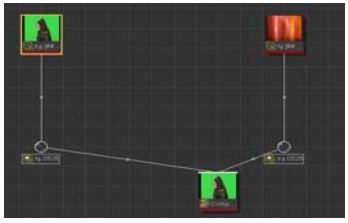

Figure 94. Schematic.

Figure 95. Output.

2. Configure the viewport layout to give you multiple viewers. On one view your schematic, another your comp output and on the final one a copy of the source footage.

Add a Keylight operator between the source footage and the comp node.

Figure 96. Viewer Layout.

3. Bring up the Keylight control panel, click on the source viewer, then on the Screen Colour eyedropper. Try picking from an area of screen colour on the source image and seeing how the final output looks. If necessary switch the view to either status or screen matte to see what the alpha looks like. Sample from a few different regions and see how the output looks, then pick from the area which appeared best. In many cases this can be the make or break factor for a key, so ensuring you get a good initial key will make tweaking the matte a far easier process.

Figure 97. Output.

Figure 98. Status.

4. The matte generated can be refined using the matte processing tools native to Keylight, however, for the purposes of this tutorial we are first going to investigate the use of inside and outside masks. These are extra inputs to the plug-in which limit the areas to which the key generated are applied. First off, lets try using an outside mask. These are generally useful where the background screen has been unevenly lit, or where lighting rigs have protruded into shot. On the schematic drop a new Mask->Draw Mask operator and wire it onto the original footage as shown in Figure 99. Now, by setting your viewer to look at the Draw Mask operator and click on one of the mask creation tools you can draw directly onto the footage in question. Draw a loose garbage matte around the subject and animate as required (in this case animation is not necessary as the subject is not in motion).

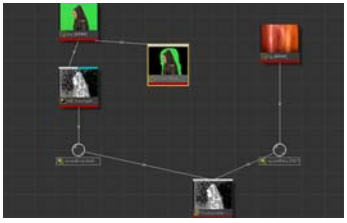

Figure 99. Draw Mask Node.

Figure 100. Draw Mask Output.

5. Pipe the output of the create mask node into the outside mask Keylight input (drop over the blue strip and select outside mask from the drop down list). Now from the Keylight control panel pick 'Matte Layer Inverse Alpha' from the 'Mask With' drop down under Outside Mask. Now you have effectively told Keylight to ignore everything outside of the mask you've drawn.

6. Inside masks, on the other hand, are used to prevent unwanted transparency in the foreground object, or to restore original subject colours. In a similar manner to before create a new branch with a 'Draw Mask' node, and draw a vector around some internal detail. Pipe this into the Inside Mask input and select 'Matte Layer Alpha' from the 'Mask With' drop down under Inside Mask. By altering the 'Replace...' options in the same column you are able to set how the colours inside this mask are reproduced (this comes in handy when Keylight is removing some foreground colour that is close to the screen colour, when you do not want it too).

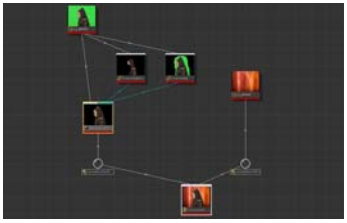

Figure 101. Inside Mask.

Figure 102. Output.

7. You may notice that in the same 'Inside Mask' column there is an option for using the alpha channel embedded in the source input for the inside mask. This comes in very handy when setting up a multipass key. For example, imagine you have a problematic key whereby you can set Keylight up to maintain good edge detail, at the cost of partially transparent inside regions, or you have have a good solid inner key, but where the edge detail has been destroyed. Now, you could manually draw in an inside mask and animate it, however there is a far easier option, which the following steps outline. For this part of the exercise remove the matte nodes and reset Keylight to its defaults.

8. Click on this Keylight node and pick a good colour region. Switch the output to 'Status' and, using the Clip Black and Clip White make the matte virtually binary (i.e. either in one state or another, so each pixel is either black or white). I find a Clip Black of 47 and a Clip White of 60 is adequate. As we want this key to be solely for the hard inside areas shrink the matte using the Screen Shrink/ Grow control (-15 is a good rough value). For some keys you will also need to employ the despot controls to remove any remaining grey 'holes' in the matte.

Figure 103. Heavily eroded Screen Matte.

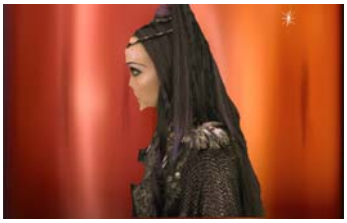

Figure 104. Intermediate Result.

9. Switching to 'Intermediate' output renders the input RGB channels with the matte calculated in the A channel. It looks a bit odd at this point, but you have to bear in mind that Combustion is showing you the RGB multiplied by A: in actual fact the RGB data in regions of zero A still exists: it's merely not being shown. Wire in a second Keylight directly on the output of the first and pick a good green for the screen colour from the source viewer. Switch the Inside Mask 'Source Alpha' drop down to 'Add to Inside Mask'. We are now using the matte created in the first Keylight as the inside mask for the second Keylight. The second pass Keylight can now be tweaked to

give optimal edge detail without the worry of losing full subject opacity in the inner areas.

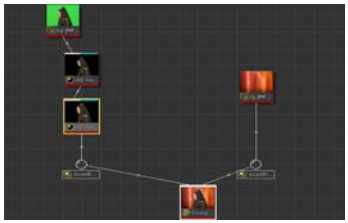

Figure 105. Schematic.

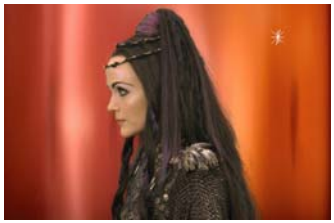

Figure 106. Final Output.

APPENDIX A

Release Notes

This appendix describes the requirements, new features, improvements over previous versions, fixed bugs and known bugs and workarounds in Keylight.

Keylight 1.2v7

This is a maintenance release of Keylight to fix a bug.

Requirements

Autodesk Combustion 4 on Windows only. (Combustion on Mac is not supported)

Release Date

September 2007

New Features

There are no new features.

Improvements

There are no improvements to existing features.

Fixed Bugs

1. Background Rendering - BUG ID 2293 - background rendering scripts with keylight nodes would use a Foundry FLEXlm interactive (GUI) license (keylight_ae_i) rather than a FLEXlm render license (keylight_ae_r). This has been fixed.

Known Bugs and Workarounds

1. Multiprocessing - BUG ID 194 - There is a multiprocessing rendering bug shown up as half screen renders. Only seen on Intel PCs with dual core. As a workaround you could temporarily set the environment variable FOUNDRY_MAX_PROCESSORS to 1.

Keylight 1.2v2

This is a maintenance release of Keylight to fix some bugs.

Requirements

Autodesk Combustion 4 on Windows only. (Combustion on Mac is not supported)

Release Date

December 2006

New Features

There are no new features.

Improvements

There are no improvements to existing features.

Fixed Bugs

1. SSE2 - BUG ID 801 - the previous version of Keylight was compiled with a sse2 flag preventing it from working on very old hardware running Windows. This version has been recompiled with sse1 to fix this problem affecting a minority of customers.
2. Seperator - BUG ID 763 - using the scroll wheel to select options in an option toggle would allow the selection of the seperator and this caused a crash. The seperator has been removed to fix the bug.

Known Bugs and Workarounds

1. Multiprocessing - BUG ID 194 - There is a multiprocessing rendering bug shown up as half screen renders. Only seen on Intel PCs with dual core. As a workaround you could temporarily set the environment variable FOUNDRY_MAX_PROCESSORS to 1.

Keylight 1.2v1

This is the first release of Keylight to support Combustion.

Requirements

Autodesk Combustion 4 on Windows only. (Combustion on Mac is not supported)

Release Date

November 2006

New Features

1. FLEXlm license support for Combustion.

Improvements

1. The bias controls are now locked together by default.
2. The Keylight algorithm has been tweaked for improved floating point handling.
3. An environment variable (FOUNDRY_MAX_PROCESSORS 1) has been provided to switch off multi-processing as a temporary workaround for Bug ID 194.
4. Keylight is now versioned by name. This allows multiple versions of the plug-in to coexist on a single host.
5. 3GB Switch - the plug-ins have been compiled to take advantage of extended memory available in this mode.

Fixed Bugs

1. Inside Mask, Source Alpha set to Add To Inside Mask. When viewing the Status with the source alpha added to the inside mask the combined mattes were not drawn on screen even though the matte had been added. This has been fixed so that the Status correctly shows these combined mattes.
2. Source Crops - BUG ID 224 - changing the left crop value from 0 when X Method is Colour, produces a rendering error in the colour correction edges. This has been fixed.
3. Installer - BUG ID 223 - Keylight could only be installed to the default directory. This has been fixed.
4. Colour Correction Clipping - BUG ID 225 - colour correction of the foreground or edges is incorrectly clipped between 0 and 1 for floating point images. This has been fixed.

Known Bugs and Workarounds

1. Multiprocessing - BUG ID 194 - There is a multiprocessing rendering bug shown up as half screen renders. Only seen on Intel PCs with dual core. As a workaround you could temporarily set the environment variable FOUNDRY_MAX_PROCESSORS to 1.
2. Colour Wheel - BUG ID 732 - after setting keys for the huw, the colour wheel crosshairs do not update correctly when jumping along the timeline. However, the parameter animates correctly and the correct value is shown.

Known Bugs with Combustion and Workarounds

1. Colour pickers on the Combustion schematic - BUG ID 733 - when schematic selected, activating and deactivating a colour picker occasionally results in the colour picker tool only being activated. When this happens hit

F12 twice to flick the schematic to a viewer and then back again.

2. Parameter callbacks - BUG ID 751 - moving the crosshairs in the colour correction colour wheel cannot update both the hue and saturation parameter. As a workaround, only the hue parameter is updated. The saturation can only be adjusted with the slider.

APPENDIX B

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